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A system and method for tracking individualsField of the invention

The present invention relates to tracking of individuals in a flock by means of radio communication and positioning systems.

Background of the invention

As long as livestock farming has existed, it has always been necessary to herd animals, protecting them against predators and accidents, and keeping them together for making the loss of animals as low as possible.

Even today, traditional herding, which has been used for thousands of years where one or more persons always follow the flock as long as they are on free pasture, is the most common.

Naturally, this old fashioned herding is very expensive as it continuously occupies human resources in a very ineffective way. This is the reason why many farmers have decided to skip herding, but, as a consequence, by the end of the season the loss of animals has been considerable.

However, there is an increasing demand in the public opinion for high food quality, but also for a good treatment of the animals in their lifetime.

One way of remotely tracking animals is to place a VHF radio transmitter on the individual animals of interest and determining their approximate positions based upon the signal strength of the radio signals from the transmitter at a receiver. This solution has traditionally been used for scientific purposes on wild individual animals. It is not designed for collecting data other than for an approximate position, and each monitored individual animal must be provided with a long distance transmitter, which

will be relatively expensive for a whole flock. Besides, a transmitter also transmitting additional condition data, e.g., body temperature and humidity, would be rather heavy.

From US patents 5,868,100 and 5,791,294, US patent
5 application 2002/0021219 and European patent application EP
945060 there are known a number of more or less similar
systems for tracking and monitoring animals. Each monitored
animal is wearing an electronic device comprising
communication and positioning equipment. The positioning
10 equipment is a GPS unit. Such devices tend to become heavy
and are therefore not suited for young animals. In
addition, the devices are costly. Thus, such systems are
less applicable for tracking and monitoring flocks of
livestock; they are used nearly exclusively for monitoring
15 single individual animals for scientific purposes.

Consequently, there is a need for a system remotely
tracking animals in a flock with a minimum of heavy
equipment and with the possibility of monitoring the
condition and health of the animals.

20 Summary of the invention

It is an object of the present invention to provide a
system and method which allows monitoring of all animals of
a flock with only a cheap and simple short distance
transceiver (e.g. as an ear marker) placed on each animal.

25 Another object of the present invention is to keep track of
the animals even when they roam from one flock to another,
without being regarded as lost.

The objects above is achieved in a system according to the
invention for tracking individuals divided into one or more
30 flocks, wherein at least one individual in each flock, from
now on called the flock leader, being provided with a first
electronic device including a position tracker and radio

communication equipment, in which system said radio communication equipment includes at least a first transceiver operating in a public radio communication network, and a second transceiver operating in a short distance radio system, at least one other individual belonging to a flock being provided with a second electronic device, said second electronic device including at least a third transceiver also operating in the short distance radio system and being arranged to communicate with the second transceiver of said radio communication equipment, each second electronic device being arranged to transmit at least an identification code uniquely identifying said second device to a first electronic device present in the flock through the short distance radio system, thereby indicating the presence of the associated individual in a flock.

The invention also comprises a method involving to provide at least one individual in each flock, called the flock leader, with a first electronic device, said first electronic device including a position tracker, a first transceiver operating in a public radio communication network, and a second transceiver operating in a short distance radio system, to provide at least one other individual belonging to a flock with a second electronic device, said second electronic device including a third transceiver also operating in the short distance radio system, to transmit from each second electronic device at least an identification code uniquely identifying said second device to a first electronic device present in the flock through the short distance radio system, thereby indicating the presence of the associated individual in a flock.

Other embodiments of the invention appear from the appended dependent claims.

Brief description of the drawing

The invention will now be described in detail in reference to the appended drawings, in which

Figure 1 is an overview of the structure of the system according to the present invention,

5 Figure 2 shows a collar to be worn by bell sheep,

Figure 3 shows an ear mark to be worn by junior sheep.

Detailed description of preferred embodiments

In the following, the invention will be described in connection with animal flocks and herding. However, the
10 reader should keep in mind that man is an animal species. Thus, the invention may advantageously be utilized for tracking other individuals gathered together, e.g. as a security system for human beings travelling in groups. The invention may also find application for keeping track of
15 persons present in a building complex, and evacuating said persons in case of an emergency. For that means, the invention may be used for keeping track of non-living "individuals", e.g. in an automated stock keeping system. Therefore, the term "individual" must be interpreted in the
20 widest possible way, covering both living beings and inanimate objects.

The present invention takes advantage in the fact that animals on pasture tend to follow each other in a flock. Animals like sheep, cattle and reindeer are by nature
25 gregarious animals and it is also in the farmer's interest that the animals always stay in a flock.

The system according to the present invention comprises a main terminal localized on the leader of the flock - from now on called the bell sheep, or alternatively on a limited
30 number of the animals within the flock. This main terminal is preferably a terminal operating in a public radio

communication network like GSM, GPRS, UMTS, or even WLAN. In addition, a position tracker, preferably a GPS receiver, is integrated in the main terminal. For communication with the other animals in the flock, the main terminal is also provided with a short distance radio transceiver, e.g. a Bluetooth® device or a device operating in the ISM frequency bands or other open frequency bands (like 433 MHz). The communication with the respective distributed terminals is separated according to the protocol being used (e.g. Bluetooth® or 433 MHz protocol). The main terminal can be worn by the bell sheep in a collar. Bluetooth® is a trademark owned by Bluetooth SIG, Inc. The Bluetooth® system is a short range radio communication system operating on 2.4 GHz.

The main terminal is illustrated in Fig. 2. The main terminal 1, also called the first electronic device, includes a positioning device 2, a first radio transceiver 3 operating in the public radio network and a second radio transceiver 4 operating in a short range communication system, as detailed above. The main terminal 1 can be fastened to a bell sheep with a collar 5. In addition, the main terminal 1 includes a source of electric power, e.g. a battery (not shown).

Each of the other animals in the flock is provided with a much simpler terminal adapted to communicate with the main terminal placed on the bell sheep by means of the chosen short distance communication system (e.g. Bluetooth® or 433 MHz). Preferably, this terminal should be small enough to form an earmark on the animal's ear.

A possible embodiment of such a simplified terminal is shown in Fig. 3. The terminal 6 is designed as a common earmark with an embedded third radio transceiver 7 operating in the short range communication system mentioned above. The terminal 6 is equipped with a power source, preferably a battery (not shown).

Each distributed terminal 6 is assigned an identification (ID) uniquely identifying the associated animal. The short distance radio transceiver 4 in the main terminal will act as a mobile base station and portal for the distributed terminals within the flock. The mobile base stations for a number of flocks in the system then create a dynamic piconet structure of moving coverage areas.

The distributed terminals 6 are only able to communicate with the main terminal 1 when the respective animals are localized within the coverage area of the main terminal 1. In other words, an animal is regarded as being lost from the flock when the main terminal is unable to communicate with the distributed terminal 6 of the respective animal.

Furthermore, the main terminal 1 may be provided with a processor and a memory for storing and processing the data received from the distributed terminals. This data includes as a minimum the above-mentioned ID. Preferably, the data may also include different condition data, e.g. body temperature, collected from different sensors on the animal. The time period between transmissions of data to the main terminal may be constant, e.g. 5 - 10 min., and when the distributed terminals 6 are not transmitting, they are set in an idle mode for saving battery power.

According to the system of the present invention, and as already indicated, the main terminal 1 will always know the presence of all the animals in the flock, simply by checking if the respective distributed terminals 6 transmit data and/or respond on a request. Any change in the presence condition for an animal will be reported to the central system controller described below. The system will also keep track of the position of the bell sheep, and hence also the approximate position of the rest of the flock, due to the positioning system integrated in the main terminal and the fact that the animals in communication with the bell sheep have to be in the proximity of the bell

sheep. The positioning system can be a GPS receiver or any other means for obtaining position information, e.g. means for fetching said information from a mobile network.

5 This presence and positioning information, and possibly the additional data mentioned above, will then be available to the external world due to the fact that the main terminal is connected to a public radio communication network like GSM, GPRS, UMTS, or WLAN.

10 According to a preferred embodiment of the invention, each individual animal may roam from one flock to another and then start communicating with the bell sheep in a new flock. The roaming animal will then be registered as a member of the new flock and deleted in the old flock, and repositioned according to the position of the bell sheep.

15 The system includes a central system controller which *inter alia* manages the availability of the data in each flock and the roaming feature mentioned above. The system controller is arranged to store (e.g. in a database) all animals registered in the system and associated information, such
20 as in which flock a respective animal is presently localized, which sensors are arranged on the animal (if any), if there are any alarms active for that animal, etc. The system controller keeps track of to which flock each animal currently belongs in that when a main terminal of a
25 flock detects signals transmitted from a new roaming animal, it will relay the ID of the animal to the central system controller and mark it as an ID of a new member of the flock. The central system controller will then update the information in its databases regarding to which flock
30 the animal currently belongs.

The system controller includes middleware and provides an application interface allowing a third part system developer to fetch data from the animals and to configure the system. The functionalities of the application

interface should preferably be at the 6/7 layer in the OSI model, and the platform of the system controller is preferably based on EJB (Enterprise Java Beans).

As a user example, when a system user wants to fetch, e.g.,
5 the position of a certain animal registered in the system, the user transmits a request to the system controller. The system controller will determine to which flock the animal currently belongs, e.g. by a lookup in the database, and relay the request to the main terminal of the corresponding
10 bell sheep over the radio communication system being used. The main terminal responds by returning the current position provided by its own GPS receiver. If the request is related to other data, the main terminal will fetch the data for the animal of interest already stored in the
15 memory, or transmit a request to the distributed terminal of the animal. The middleware will also provide other features like streaming of data, configuration of equipment, monitoring of parameters, etc.

Further, according to a preferred embodiment of the present
20 invention, the system is provided with an alarm feature. An alarm associated with an animal will be activated when periodic signals from that animal fail to occur within a predefined time period since last detected signal. The alarm may, e.g., trigger sending of an e-mail or a short
25 message to a person being responsible for the animal.

The present invention utilizes the fact that short distance radio communication equipment has limited radio coverage area to detect when an animal has lost its flock. This is also utilized to determine an approximate position of an
30 animal only by providing one or a limited number of animal(s) with positioning tracker(s) (GPS receiver) per flock.